Model 1

Group (1): Choose the correct answer from those given:

[1] The sum of measures of the interior angles of any quadrilateral = ……..

(a) 90° (b) 180° (c) 270° (d) 360°

[2] The inscribed angle drawn in a semicircle is ..... angle.

(a) a straight (b) an obtuse

(c) a right (d) an acute

[3] The number of axes of symmetry of a square is .....

(a) 1 (b) 3 (c) 2 (d) 4

[4] M and N are two circles, the lengths of their radii are 9 cm, 4 cm and MN = 5 cm, then the two circles are ……..

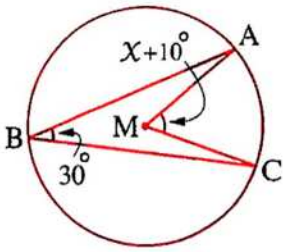
(a) distant. (b) touching internally.

(c) intersecting. (d) touching externally.

[5] The area of the circle whose diameter length is 14 cm equals ..... cm².

(a) 14 π (b) 49 π (c) 7 π (d) 28 π

[6] In the opposite figure :
M is a circle, if
m(∠ AMC) = (x + 10°),
m(∠ B) = 30°, then the value of x is …..



(a) 130° (b) 100°

(c) 50° (d) 40°

[7] ABCD is a cyclic quadrilateral, if m(∠ A) = 3m(∠ C), then m(∠A) = …..

(a) 45° (b) 90° (c) 120° (d) 135°

[8] If $\overleftrightarrow{AB}$ ∩ the circle M = {A , B}, then $\overleftrightarrow{AB}$ ∩ the surface of the circle M = …..

(a) {A , B} (b) $\overline{AB}$ (c) $\overrightarrow{AB}$ (d) $\overrightarrow{BA}$

[9] The length of the arc that subtends a central angle of measure 120° in a circle of diameter length 42 cm equals ..... cm.

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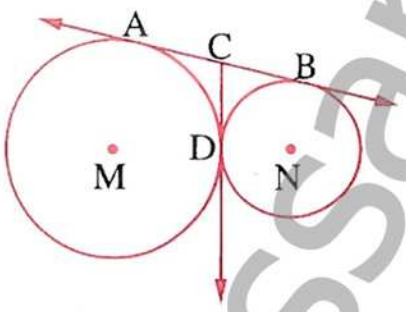
(a) 28 (b) 22 (c) 21 (d) 44

Group (2): Answer the following questions:

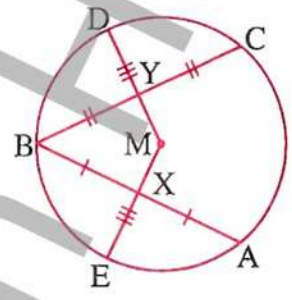
[10] In the opposite figure:



M and N are two circles touching externally at D, $\overleftrightarrow{AB}$ is a common tangent to them at A and B, $\overrightarrow{CD}$ is a common tangent to them at D

Prove that: C is the midpoint of $\overline{AB}$.

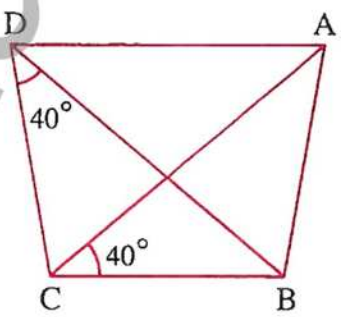
[11] In the opposite figure:



If $\overline{AB}$ and $\overline{BC}$ two chords in circle M, X is the midpoint of $\overline{AB}$, Y is the midpoint of $\overline{BC}$ and XE = YD

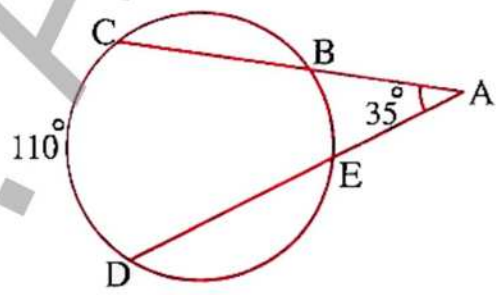
Prove that: AB = BC

[12] In the opposite figure:



If ABCD is a cyclic quadrilateral, m (∠BDC) = m (∠ACB) = 40°, then **prove that:** Δ ABC is isosceles.

[13] In the opposite figure:



If $\overrightarrow{CB} \cap \overrightarrow{DE} = \{A\}$, m (∠A) = 35° and m $(\overset{\frown}{CD})$ = 110°, then find: m $(\overset{\frown}{BE})$.

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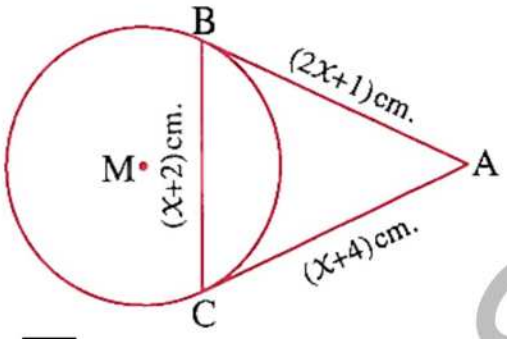
[14] In the opposite figure:



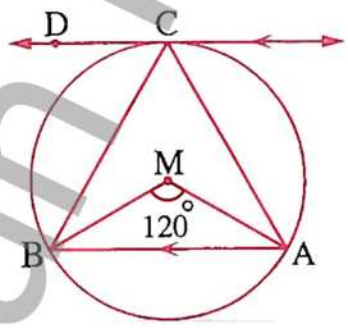
$\overline{AB}$ and $\overline{AC}$ are two tangent-segments to the circle M at B and C respectively, AB = (2x + 1) cm, AC = (x + 4) cm and BC = (x + 2) cm.

(1) Find the value of x.

(2) Calculate the perimeter of Δ ABC.

[15] In the opposite figure:

The circle M passes through the vertices of Δ ABC, m (∠ AMB) = 120°, $\overleftrightarrow{CD}$ is a tangent to the circle M at C and $\overleftrightarrow{CD}$ // $\overline{AB}$.



Prove that: The Δ ABC is an equilateral.

[16] By using the geometric instruments, draw AB of length 4 cm, then draw a circle passes through the two points A and B and its radius length 3 cm, what is the number of solutions?

Answers

Group (1):

[1] (d) [2] (c) [3] (d) [4] (b)

[5] (b) [6] (c) [7] (d) [8] (b)

[9] (d)

Group (2):

[10] ∵ $\overrightarrow{CA}$ and $\overrightarrow{CD}$ are two tangents to the circle M.

∴ CA = CD ⟶ (1)

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∵ $\overleftrightarrow{CD}$ and $\overleftrightarrow{CB}$ are two tangents to the circle N.

∴ CD = CB ⟶ (2)

From (1) and (2): ∴ CA = CB

∴ C is the midpoint of $\overline{AB}$ (Q.E.D.)

[11] ∵ MD = ME = r, ∵XE =YD,

By subtracting: ∴ MX = MY

∵ X is the midpoint of $\overline{AB}$ ∴ $\overline{MX} \perp \overline{AB}$

∵ Y is the midpoint of $\overline{BC}$ ∴ $\overline{MY} \perp \overline{BC}$

∴ AB = BC (Q.E.D.)

[12] ∵ ABCD is a cyclic quadrilateral.

∴ m (∠BAC) = m (∠ BDC) = 40°

(they are drawn on $\overline{BC}$ and on one side of it).

In Δ ABC:

∴ m (∠BAC) = m (∠ACB) = 40°

∴ AB = BC ∴ Δ ABC is isosceles. (Q.E.D.)

[13] ∵ m (∠A) = ½ [m ($\overset{\frown}{CD}$) – m ($\overset{\frown}{BE}$)]

∴ 35° = ½ [110° − m ($\overset{\frown}{BE}$)]

∴ 70° = 110° − m ($\overset{\frown}{BE}$)

∴ m ($\overset{\frown}{BE}$) = 110° − 70° = 40° (The req.)

[14] ∵ $\overline{AB}$ and $\overline{AC}$ are two tangent-segments to the circle M.

∴ AB = AC ∴ $2x + 1 = x + 4$

∴ $x = 3$ (The first req.)

∴ AB = AC = 7 cm and BC = 5 cm.

∴ The perimeter of Δ ABC = 7 + 7 + 5

= 19 cm. (The second req.)

[15] ∵ m (∠ACB) = ½ m (∠AMB)

(Inscribed and central angles subtended by $\overset{\frown}{AB}$)

∴ m (∠ ACB) = $\frac{1}{2} \times 120° = 60°$ ⟶ (1)

∵ $\overleftrightarrow{CD}$ // $\overline{AB}$ ∴ m ($\overset{\frown}{CA}$) = m ($\overset{\frown}{CB}$)

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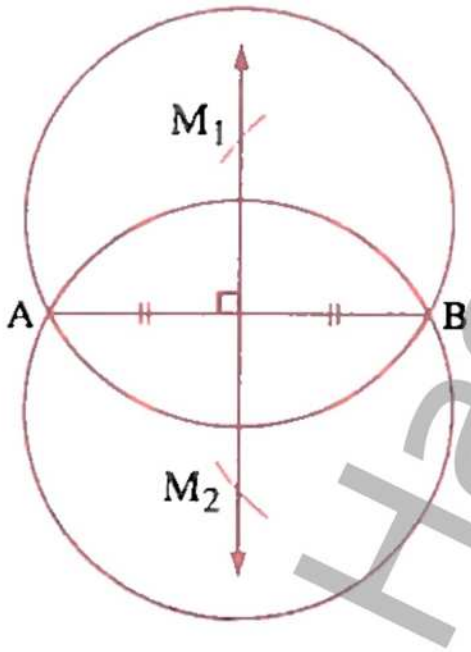
∴ CA = CB ⟶ (2)

From (1) and (2):

∴ Δ ABC is an equilateral. (Q.E.D.)

[16]



The number of solutions = 2

Model 2

Group (1): Choose the correct answer from those given:

[1] If $\overline{AB}$ and $\overline{AC}$ are two tangents to the circle from the outside point A, then AB …… AC.

(a) > (b) < (c) // (d) =

[2] A tangent to a circle of diameter length = 6 cm is at a distance of …… cm.

(a) 2 (b) 3 (c) 6 (d) 12

[3] The line segment joins between two points one of them is the center of the circle and another one on the circle is called a ……

(a) radius. (b) chord.

(c) diameter. (d) tangent of the circle.

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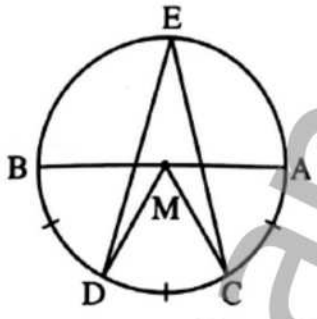
[4] In the opposite figure:

$\overline{AB}$ **is a diameter in a circle M, if m($\overset{\frown}{AC}$) = m($\overset{\frown}{CD}$) = m ($\overset{\frown}{DB}$), then m(∠ CED) = … °**



(a) 30 (b) 60

(c) 90 (d) 180

[5] The center of the inscribed circle of a triangle is the point of intersection of ...

(a) its medians. (b) axes of its sides.

(c) its altitudes.

(d) bisectors of its interior angles.

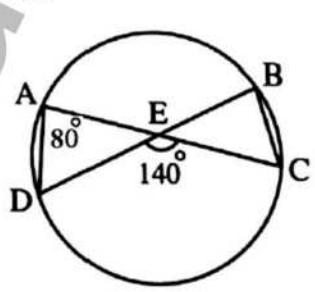
[6] The number of axes of symmetry of two congruent circles touching externally equals .....

(a) 1 (b) 2

(c) 4 (d) an infinite number.

[7] In the opposite figure:

If m (∠ CED) = 140, m (∠ A) = 80°, then m (∠ C) = …… °



(a) 30 (b) 40
(c) 50 (d) 60

[8] If $\overleftrightarrow{AB}$ ∩ the circle M = {A , B}, then $\overleftrightarrow{AB}$ ∩ the surface of the circle M = …..

(a) {A , B} (b) $\overline{AB}$ (c) $\overrightarrow{AB}$ (d) $\overrightarrow{BA}$

[9] ABCD is a cyclic quadrilateral, if m(∠ A) = 3m(∠ C), then m(∠ A) = …..

(a) 45° (b) 90° (c) 120° (d) 135°

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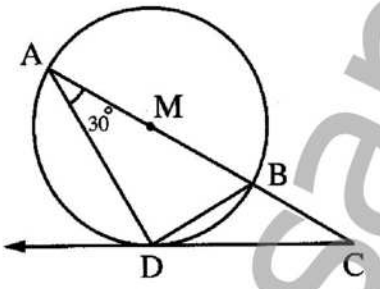
Group (2): Answer the following questions:

[10] In the opposite figure:

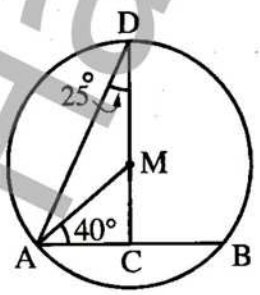
If $\overline{AB}$ is a diameter of the circle M, $\overrightarrow{CD}$ is a tangent to the circle at D, m (∠ BAD) = 30°.



Prove that: BC = BD.

[11] In the opposite figure:

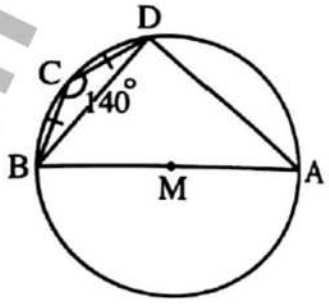
$\overline{AB}$ is a chord of the circle M, m (∠ D) = 25° and m (∠ MAC) = 40°.



Prove that: C is the midpoint of $\overline{AB}$.

[12] In the opposite figure:

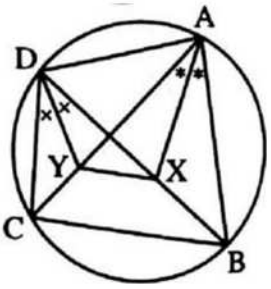
$\overline{AB}$ is a diameter in the circle M, the two points D and C belong to the circle M where DC = BC and m(∠ DCB) = 140°.



Find: (1) m (∠ A). (2) m (∠ ADC).

[13] In the opposite figure:

ABCD is a cyclic quadrilateral in the circle, $\overrightarrow{AX}$ bisects ∠ BAC and $\overrightarrow{DY}$ bisects ∠ BDC



Prove that: AXYD is cyclic quadrilateral.

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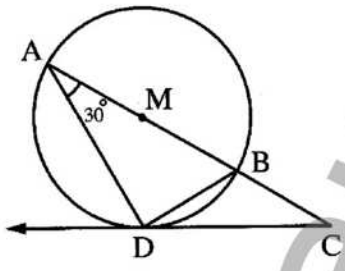
[14] In the opposite figure:

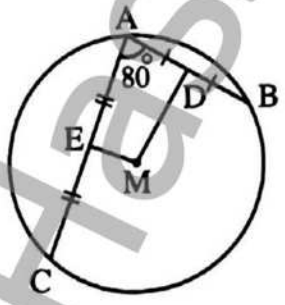
If $\overline{AB}$ is a diameter of the circle M, $\overrightarrow{CD}$ is a tangent to the circle at D, m (∠ BAD) = 30°.



Prove that: BC = BD.

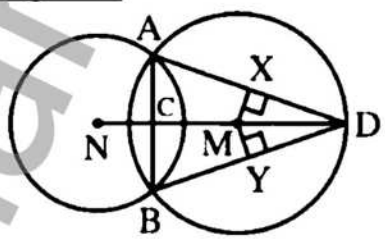
[15] In the opposite figure:

$\overline{AB}$ and $\overline{AC}$ are two chords of a circle M in two opposite sides of M where m (∠ B AC) = 80°, if D and E are the midpoints of $\overline{AB}$ and $\overline{AC}$ respectively, Find: m (∠ DME).



[16] In the opposite figure:

The circle M ∩ the circle N = {A , B}, $\overleftrightarrow{AB} \cap \overleftrightarrow{MN} = \{C\}$, $D \in \overleftrightarrow{MN}$, $\overleftrightarrow{MX} \perp \overline{AD}$ and $\overleftrightarrow{MY} \perp \overline{BD}$.



Prove that: MX = MY.

Answers

Group (1):

[1] (d) [2] (b) [3] (a) [4] (a)

[5] (d) [6] (b) [7] (d) [8] (b)

[9] (d)

Group (2):

[10] ∵ $\overrightarrow{CD}$ is a tangent to the circle at D

∴ m (∠ CDB) (tangency) = m (∠BAD) (inscribed) = 30°

∵ $\overline{AB}$ is a diameter of the circle M.

∴ m (∠ ADB) = 90°

In Δ ABD:

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$\because$ m ($\angle$ ADB) = 90° and m ($\angle$ BAD) = 30°

$\therefore$ m ($\angle$ CBD) = 90° + 30 = 120°

(An exterior angle of Δ ABD)

In Δ BCD:

$\because$ m ($\angle$ CDB) = 30 ° and m ($\angle$ CBD) = 120°

$\therefore$ m ($\angle$ C) = 180° – (120° + 30°) = 30°

$\therefore$ m ($\angle$ C) = m ($\angle$ CDB) = 30°

$\therefore$ Δ BCD is an isosceles triangle.

$\therefore$ BC = BD (Q.E.D.)

[11] $\because$ MA = MD = r

$\therefore$ Δ AMD is an isosceles triangle.

$\therefore$ m ($\angle$ DMA) = m ($\angle$ ADM) = 25°

$\therefore$ m ($\angle$ DAC) = 25° + 40° = 65°

In Δ ADC:

$\therefore$ m ($\angle$ ACD) = 180° − (25° + 65°) = 90°

$\therefore$ $\overline{DC} \perp \overline{AB}$ $\because$ M $\in$ $\overline{DC}$

$\therefore$ C is the midpoint of $\overline{AB}$. (Q.E.D)

[12] $\because$ ABCD is a cyclic quadrilateral.

$\therefore$ m ($\angle$A) + m ($\angle$ DCB) = 180°

$\therefore$ m ($\angle$ A) = 180° − 140° = 40°

(Frist req.)

$\because$ $\overline{AB}$ is a diameter in the circle M

$\therefore$ m ($\angle$ ADB) = 90°

In Δ BCD: $\because$ CB = CD

$\therefore$ m ($\angle$ CDB) = $\frac{180° - 140°}{2}$ = 20°

$\therefore$ m ($\angle$ ADC) = 90° + 20° = 110°

(Second req.)

[13] $\because$ m ($\angle$ BAC) = m ($\angle$ BDC)

(Two inscribed angles subtended by $\overset{\frown}{BC}$)

$\therefore$ $\frac{1}{2}$ m ($\angle$ BAC) = $\frac{1}{2}$ m ($\angle$ BDC)

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$\therefore$ m ($\angle$ XAY) = m ($\angle$ XDY) and both angles are drawn on the same side of $\overline{XY}$.

[14] $\therefore$ AXYD is a cyclic quadrilateral.

$\because$ $\overline{AB}$ is a diameter of the circle M.

$\therefore$ m ($\angle$ ADB) = 90°

$\because$ $\overrightarrow{CD}$ is a tangent to the circle at D

$\therefore$ m ($\angle$ CDB) (tangency) = m ($\angle$BAD) (inscribed) = 30°

In Δ ACD:

$\therefore$ m ($\angle$ C) = 180° – (120° + 30°) = 30°

In Δ BCD:

$\because$ m ($\angle$ C) = m ($\angle$ CDB) = 30°

$\therefore$ Δ BCD is an isosceles triangle.

$\therefore$ BC = BD (Q.E.D.)

[15] $\because$ D is the midpoint of $\overline{AB}$

$\therefore$ $\overline{MD} \perp \overline{AB}$ $\therefore$ m ($\angle$ ADM) = 90°

$\because$ E is the midpoint of $\overline{AC}$

$\therefore$ $\overline{ME} \perp \overline{AC}$ $\therefore$ m ($\angle$ AEM) = 90°

From the quadrilateral ADME:

m ($\angle$ DME) = 360° – (90° + 90° + 80°)

= 100° (The req.)

[16] $\because$ The circle M $\cap$ the circle N = {A , B}

$\therefore$ $\overleftrightarrow{MN}$ is the axis of symmetry of $\overline{AB}$

$\therefore$ In Δ ABD:

$\overleftrightarrow{DC}$ is the axis of symmetry of $\overline{AB}$

$\therefore$ AD = BD

$\because$ $\overline{MX} \perp \overline{AD}$ and $\overline{MY} \perp \overline{BD}$

$\therefore$ MX = MY (Q.E.D.)

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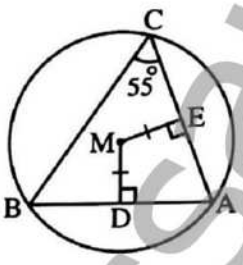
Model 3

Group (1): Choose the correct answer from those given:

[1] In the opposite figure:
m(∠C) = 55°, MD = ME,
$\overline{MD} \perp \overline{AB}$ and $\overline{ME} \perp \overline{AC}$,
then m (∠A) = …..°



(a) 55 (b) 60
(c) 70 (d) 90

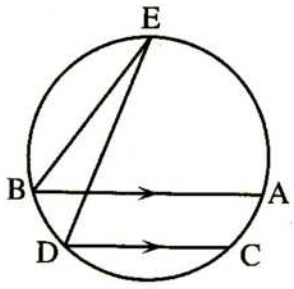
[2] If ABCD is a square drawn inside a circle, then m ($\overset{\frown}{AB}$) = ……°

(a) 60 (b) 90 (c) 120 (d) 180

[3] The ratio between the measure of the inscribed angle and the measure of the central angle subtended by the same arc = ……

(a) 1 : 2 (b) 2 : 1 (c) 1 : 1 (d) 1 : 3

[4] In the opposite figure:
If $\overline{AB}$ and $\overline{CD}$ are two parallel cords,
m ($\overset{\frown}{AC}$) = 30°, then
m (∠BED) = ……°

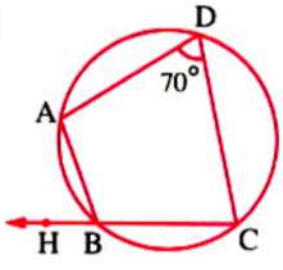


(a) 10 (b) 15
(c) 30 (d) 60

[5] The number of common tangents that can be drawn to two concentric circles is ……

(a) 0 (b) 1 (c) 2 (d) 4

[6] In the opposite figure:
If m (∠ ADC) = 70°,
then m (∠ ABH) = ……°



(a)35 (b) 70
(c) 110 (d) 140

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[7] If r_1 and r_2 are the radii of the two circles M, N and MN > $r_1 + r_2$, then the two circle are ……..

(a) distant. **(b) touching externally.**

(c) intersecting. **(d) touching internally.**

[8] The circumference of the circle whose diameter length is 6 cm equals ……. cm.

(a)3π **(b) 6π** **(c) 9π** **(d) 12π**

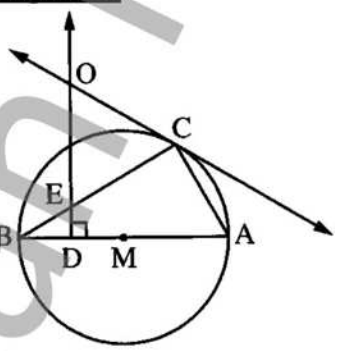
[9] If the area of a square is 50 cm^2, then the length of its diagonal is ..... cm.

(a) 5 **(b) 10** **(c) 15** **(d) 25**

<u>Group (2): Answer the following questions:</u>

<u>[10] In the opposite figure:</u>

$\overline{AB}$ is a diameter in a circle M, $\overleftrightarrow{CO}$ is a tangent at C and $\overrightarrow{DE} \perp \overline{AB}$.



<u>Prove that</u>:

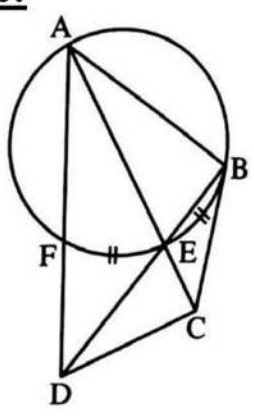
(1) The figure ADEC is a cyclic quadrilateral.

(2) OC = OE.

[11] Draw the circle which passes through the vertices of Δ ABC such that AB = 3 cm, BC = 4 cm and AC = 5 cm.

<u>[12] In the opposite figure:</u>

$\overline{BC}$ touches the circle at B, if E is the midpoint of $\overline{BF}$



<u>Prove that:</u>

ABCD is a cyclic quadrilateral.

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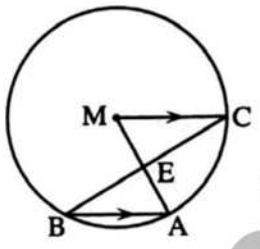
[13] In the opposite figure:

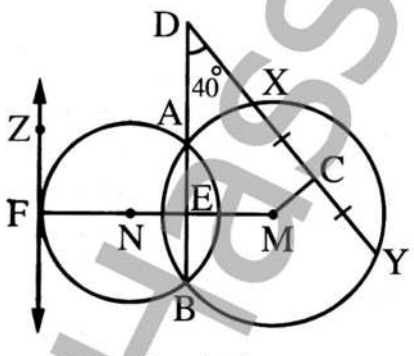
$\overline{AB}$ is a chord in the circle M, $\overline{CM} \parallel \overline{AB}$ and $\overline{BC} \cap \overline{AM} = \{E\}$



Prove that: BE > AE

[14] In the opposite figure:

M and N are two intersecting circles at A and B, C is the midpoint of $\overline{XY}$, m (∠ D) = 40°, $\overleftrightarrow{FZ}$ is a tangent to the circle N at F where $\overleftrightarrow{MN} \cap \overleftrightarrow{FZ} = \{ F \}$.



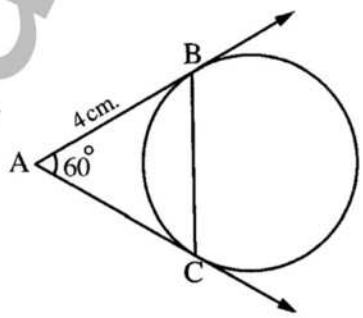
(1) Find: m (∠ CME).

(2) Prove that: $\overleftrightarrow{FZ} \parallel \overline{AB}$.

[15] In the opposite figure:

$\overrightarrow{AB}$ and $\overrightarrow{AC}$ are two tangents of the circle.

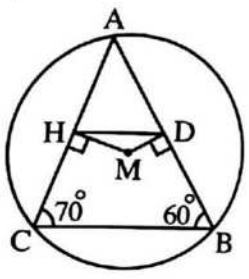
If m (∠ BAC) = 60° and AB = 4 cm, then find the length of $\overline{BC}$.



[16] In the opposite figure:

Δ ABC inscribed in the circle M, $\overline{MD} \perp \overline{AB}$, $\overline{MH} \perp \overline{AC}$, m (∠ B) = 60°, m (∠ C) = 70°.

Find with proof: The measures of the angles of Δ ADH.



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Answers

Group (1):

[1] (c) [2] (b) [3] (a) [4] (b)

[5] (a) [6] (b) [7] (a) [8] (b)

[9] (b)

Group (2):

[10] $\because \overrightarrow{DE} \perp \overline{AB}$. $\therefore m(\angle EDA) = 90°$

$\because \overline{AB}$ **is a diameter in a circle M.**

$\therefore m(\angle ACE) = 90°$

$\therefore m(\angle ACE) + m(\angle EDA) = 180°$

∴ The figure ADEC is a cyclic quadrilateral. (Q.E.D.1)

$\therefore m(\angle A) = m(\angle CEO)$ **(The exterior angle)**

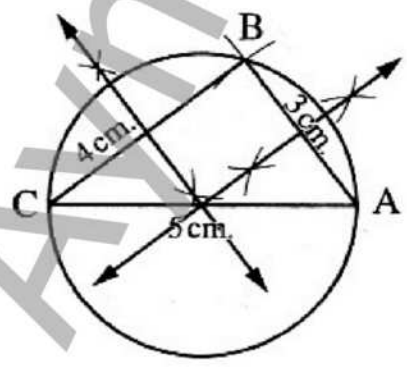
$\because m(\angle OCE)$ **(tangency)** $= m(\angle CAB)$ **(inscribed)**

$\therefore m(\angle OCE) = m(\angle CEO)$

$\therefore \Delta OCE$ **is an isosceles triangle.**

$\therefore OC = OE$ **(Q.E.D.2)**

[11]



[12] $\because$ **E is the midpoint of** $\overset{\frown}{BF}$.

$\therefore m(\overset{\frown}{BE}) = m(\overset{\frown}{EF})$

$\because m(\angle BAE) = \frac{1}{2} m(\overset{\frown}{BE})$

$m(\angle FAE) = \frac{1}{2} m(\overset{\frown}{EF})$

$\therefore m(\angle BAE) = m(\angle FAE)$

$\because \overline{BC}$ **is a tangent.**

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$\therefore$ m ($\angle$ CBD) (tangency) =

m ($\angle$ BAE) (inscribed)

$\therefore$ m ($\angle$ CBD) = m ($\angle$ CAD)

but they are drawn on $\overline{CD}$ and on one side of it.

$\therefore$ The figure ABCD is a cyclic quadrilateral. (Q.E.D.)

[13] $\because$ $\overline{CM}$ // $\overline{AB}$, $\overleftrightarrow{AM}$ is a transversal.

$\therefore$ m ($\angle$A) = m ($\angle$ AMC)

(Alternate angles)

$\because$ m ($\angle$B)= $\frac{1}{2}$ m ($\angle$ AMC)

(Inscribed and central angles subtended by $\overset{\frown}{AC}$)

$\therefore$ m ($\angle$B) = $\frac{1}{2}$ m ($\angle$A)

In Δ ABE: $\therefore$ m ($\angle$A) > m ($\angle$B)

$\therefore$ BE > AE (Q.E.D.)

[14] $\because$ $\overleftrightarrow{NM}$ is the line of centers, $\overline{AB}$ is the common chord.

$\therefore$ $\overleftrightarrow{MN} \perp \overline{AB}$ $\therefore$ m ($\angle$ AEM) = 90°

$\because$ C is the midpoint of $\overline{XY}$

$\therefore$ $\overline{MC} \perp \overline{XY}$ $\therefore$ m ($\angle$ MCX) = 90°

In The quadrilateral DOME:

m ($\angle$ CME) = 360° − (90° + 90° + 40°)

= 140° (Q.E.D. 1)

$\because$ $\overleftrightarrow{FZ}$ is a tangent to the circle N at F.

$\therefore$ $\overline{NF} \perp \overleftrightarrow{FZ}$ $\therefore$ m ($\angle$ NFZ) = 90°

m ($\angle$ MEA) = m ($\angle$ NFZ) and they are corresponding angles.

$\therefore$ $\overleftrightarrow{FZ}$ // $\overline{AB}$ (Q.E.D. 2)

[15] $\because$ $\overrightarrow{AB}$ and $\overrightarrow{AC}$ are two tangents of the circle.

$\therefore$ AB = AC $\because$ m ($\angle$ A) = 60°

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$\therefore \Delta ABC$ is an equilateral triangle.

$\therefore BC = 4$ cm. (The req.)

[16] $\because \overline{MD} \perp \overline{AB}$

$\therefore$ D is the midpoint of $\overline{AB}$.

$\because \overline{MH} \perp \overline{AC}$

$\therefore$ H is the midpoint of $\overline{AC}$

$\therefore \overline{DH} // \overline{BC}$, $\overleftrightarrow{AB}$ is a transversal.

$\therefore m(\angle ADH) = m(\angle B) = 60°$

(Corresponding angles)

$\because \overline{DH} // \overline{BC}$, $\overleftrightarrow{AC}$ is a transversal.

$\therefore m(\angle AHD) = m(\angle C) = 70°$

(Corresponding angles)

In ΔADH:

$m(\angle A) = 180° - (70° + 60°) = 50°$

(The req.)

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